



On the issue of the surface contamination of a Langmuir Probe sensor: Demeter ISL results

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Abstract

The Demeter Instrument Sonde de Langmuir (ISL) comprises two Langmuir Probe sensors. It includes a classical cylindrical sensor and a 6-sector spherical Segmented Langmuir Probe (SLP) sensor. The CNES Demeter satellite was launched in June 2004 on a 700-km altitude high-inclination orbit. ISL worked flawlessly till the satellite was decommissioned in March 2011. It provided more than 6 years of data. For operational reasons, the science payload was only operated below magnetic latitude 65° . It was switched off twice per orbit when above 65° . A transient behavior of the ISL sensors was systematically observed each time it was turned on at the beginning of each half-orbit segment. This transient behavior is attributed to surface contamination of the sensors. Some surface contamination of the sensor is indeed inferred from the recording of a series of I-V curves at different sweep rates using a special mode designed to monitor the evolution of the surface state of the sensor during the mission. As independently observed from the comparison between Demeter ISL measurements and Ground-based radar ionospheric sounding measurements, (J.-L. Berthelier, private communication, 2011) it is shown that the electron temperature measurements performed by a contaminated Langmuir Probe are significantly higher than the true physical value. Based on the work of Piel et al., a method was developed to determine the electrical characteristics of the surface contamination layer, and to remove the effect of the contamination layer on the determination of the main plasma parameters from the analysis of the I-V curve (the plasma electron density N_e and the Electron temperature T_e). Potential contamination issues for Langmuir Probes on future planetary mission orbiters will be addressed and ways to avoid or at least mitigate the effects of will be discussed.

1. Introduction

The abstract will be completed after submission, using the abstract update opportunity offered on the web site

